

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A nonvolatile magnetic memory device of the type having:

a first wiring;
a second wiring intersecting three-dimensionally with said first wiring; and
a tunnel magnetoresistance element which is electrically insulated from said first wiring and electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

said magnetic memory device comprises a magnetic flux concentrator of ~~high-permeability layer~~ formed at least on adjacent the lateral sides of said first wiring and on ~~the~~ a side of said first wiring which is opposite to the side facing said tunnel magnetoresistance element, ~~with at least either of said high-permeability layer formed on the lateral sides of said first wiring projecting from said first wiring toward said tunnel magnetoresistance element.~~

2. (Currently Amended) The magnetic memory device as defined in Claim 1, wherein the magnetic flux concentrator has the high-permeability layer formed also on the surface of the first wiring ~~close to~~ facing the tunnel magnetoresistance element.

3. (Currently Amended) The magnetic memory device as defined in Claim ~~1~~ 2, wherein an insulating film is formed between the magnetic flux concentrator and the first wiring.

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

4. (Canceled)

5. (Currently Amended) A nonvolatile magnetic memory device of the type having:

- a first wiring;
- a second wiring intersecting three-dimensionally with said first wiring; and
- a tunnel magnetoresistance element which is electrically insulated from said first wiring and electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

said magnetic memory device comprises a magnetic flux concentrator of high-permeability layer formed at least on adjacent the lateral sides of said second wiring and on the side of said second wiring which is opposite to the side facing said tunnel magnetoresistance element, ~~with at least either of said high-permeability layer formed on the lateral sides of said second wiring projecting from said second wiring toward said tunnel magnetoresistance element.~~

6. (Currently Amended) The magnetic memory device as defined in Claim 5, wherein the magnetic flux concentrator has the high-permeability layer formed also on the surface of the second wiring ~~close to~~ facing the tunnel magnetoresistance element.

7. (Currently Amended) The magnetic memory device as defined in Claim 5 ~~6~~, wherein an insulating film is formed between the magnetic flux concentrator and the second wiring.

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

Claim 8. (Canceled)

9. (Currently Amended) A nonvolatile magnetic memory device of the type having:

- a first wiring;
- a second wiring intersecting three-dimensionally with said first wiring; and
- a tunnel magnetoresistance element which is electrically insulated from said first wiring and electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

said magnetic memory device comprises a magnetic flux concentrator of high-permeability layer formed between said first wiring and said tunnel magnetoresistance element and ~~on~~ adjacent the lateral sides of said tunnel magnetoresistance element, with an insulating film interposed therebetween.

10. (Currently Amended) A nonvolatile magnetic memory device of the type having:

- a first wiring;
- a second wiring intersecting three-dimensionally with said first wiring; and
- a tunnel magnetoresistance element which is electrically insulated from said first wiring and electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

said magnetic memory device comprises a first magnetic flux concentrator of high-permeability layer formed at least ~~on~~ adjacent both of the lateral sides of said

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

first wiring and on the side of said first wiring which is opposite to the side facing said tunnel magnetoresistance element, and a second magnetic flux concentrator of high-permeability layer formed between said first wiring and said tunnel magnetoresistance element and on adjacent the lateral sides of said tunnel magnetoresistance element, with an insulating film interposed therebetween.

11. (Original) The magnetic memory device as defined in Claim 10, wherein an insulating film is formed between the first magnetic flux concentrator and the first wiring.

12. (Currently Amended) The magnetic memory device as defined in Claim 8 9, wherein at least either of the high-permeability layers formed on the lateral sides of the first wiring projects ~~from~~ beyond the first wiring and toward the tunnel magnetoresistance element.

13. (Original) The magnetic memory device as defined in Claim 12, wherein an insulating film is formed between the first magnetic flux concentrator and the first wiring.

14. (Currently Amended) A nonvolatile magnetic memory device of the type having:
a first wiring;
a second wiring intersecting three-dimensionally with said first wiring; and
a tunnel magnetoresistance element which is electrically connected to said first wiring through a switching element and is electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

said magnetic memory device comprises a magnetic flux concentrator of high-permeability layer formed at least ~~on~~ adjacent both of the lateral sides of said first wiring and ~~on~~ adjacent the side of said first wiring which is opposite to the side facing said tunnel magnetoresistance element, with at least either of said high-permeability layer formed on the lateral sides of said first wiring projecting from said first wiring toward said tunnel magnetoresistance element, and

wherein the switching element is formed substantially co-extensive with the tunnel magnetoresistance element.

15. (Original) The magnetic memory device as defined in Claim 14, wherein an insulating film is formed between the magnetic flux concentrator and the tunnel magnetoresistance element.

16. (Currently Amended) A nonvolatile magnetic memory device of the type having:

- a first wiring;
- a second wiring intersecting three-dimensionally with said first wiring; and
- a tunnel magnetoresistance element which is electrically connected to said first wiring through a switching element and is electrically connected to said second wiring and which is formed in the region of intersection of said first wiring and said second wiring such that a tunnel insulating layer is sandwiched between ferromagnetic materials which change in resistance depending on whether the spin direction is parallel or antiparallel, thereby recording information; wherein

said magnetic memory device comprises a magnetic flux concentrator of high-permeability layer formed at least ~~on~~ adjacent both of the lateral sides of said second wiring and ~~on~~ adjacent the side of said second wiring which is opposite to the side facing said tunnel magnetoresistance element, with at least either of said high-permeability layer formed on the lateral sides of said second wiring projecting from said second wiring toward said tunnel magnetoresistance element, and

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

wherein the switching element is formed substantially co-extensive with the tunnel magnetoresistance element.

17. (Currently Amended) The magnetic memory device as defined in Claim 16, wherein the magnetic flux concentrator has the high-permeability layer formed also on adjacent the surface of the second wiring ~~close to~~ facing the tunnel magnetoresistance element.

18. (Original) The magnetic memory device as defined in Claim 16, wherein an insulating film is formed between the magnetic flux concentrator and the second wiring.

19. (Currently Amended) The magnetic memory device as defined in Claim 16, wherein the magnetic flux concentrator has the high-permeability layer formed, with an insulating film interposed, also on adjacent the surface of the second wiring ~~close to~~ facing the tunnel magnetoresistance element.

Claims 20. – 38. (Canceled)

Please add the following new claims:

39. (New) The magnetic memory device as defined in Claim 1, wherein at least either of said high-permeability layer formed adjacent the lateral sides of said first wiring projects beyond said first wiring and toward said tunnel magnetoresistance element.

Appl. No. 10/508,924
Amdt. Dated February 28, 2007
Reply to Office Action of November 29, 2006

40. (New) The magnetic memory device as defined in Claim 5, wherein at least either of said high-permeability layer formed adjacent the lateral sides of said second wiring projects beyond said second wiring and toward said tunnel magnetoresistance element.